

ARMY ENGINEER TOPOGRAPHIC LABS FORT BELVOIR VA F/G 8/2  
DETECTING LINE-ROAD AND ROAD-INTERSECTION PATTERNS AT VARIOUS A--ETC(U)  
OCT 81 J R SINGLETON, P CHEN

NL

116

END  
DATE  
FILMED  
8-82  
DTIC

ETL-0274

(12)

AD A116769

Detecting line-road and  
road-intersection patterns  
at various angles

J. Robert Singleton  
Pi-Fuay Chen



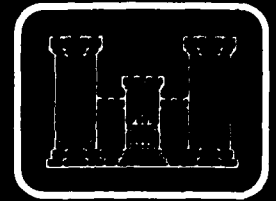
OCTOBER 1981

DTIC FILE COPY

U.S. ARMY CORPS OF ENGINEERS  
ENGINEER TOPOGRAPHIC LABORATORIES  
FORT BELVOIR, VIRGINIA 22060

82 07 09 00 6

APPROVED FOR PUBLIC RELEASE DISTRIBUTION UNLIMITED

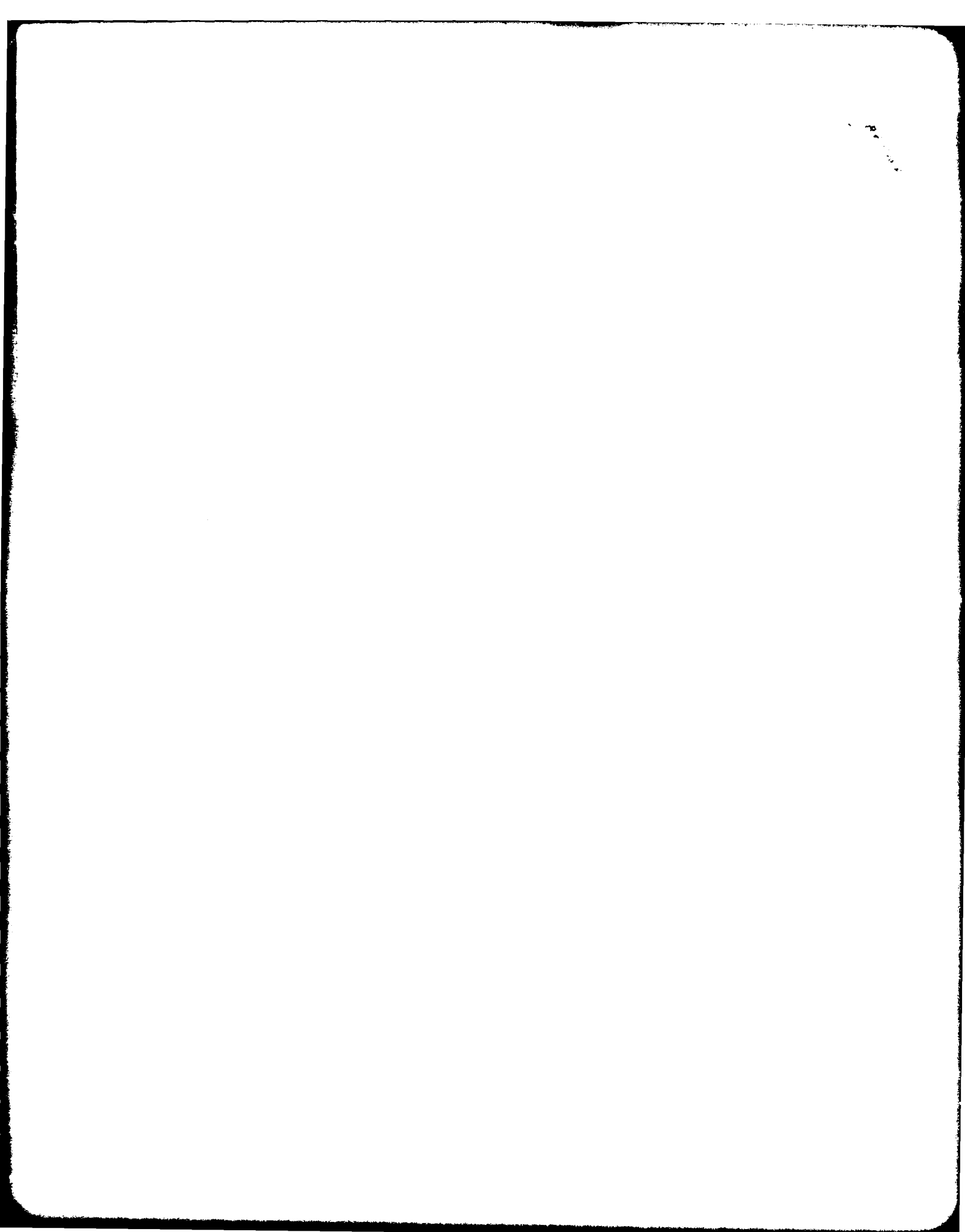


E

T

L





UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

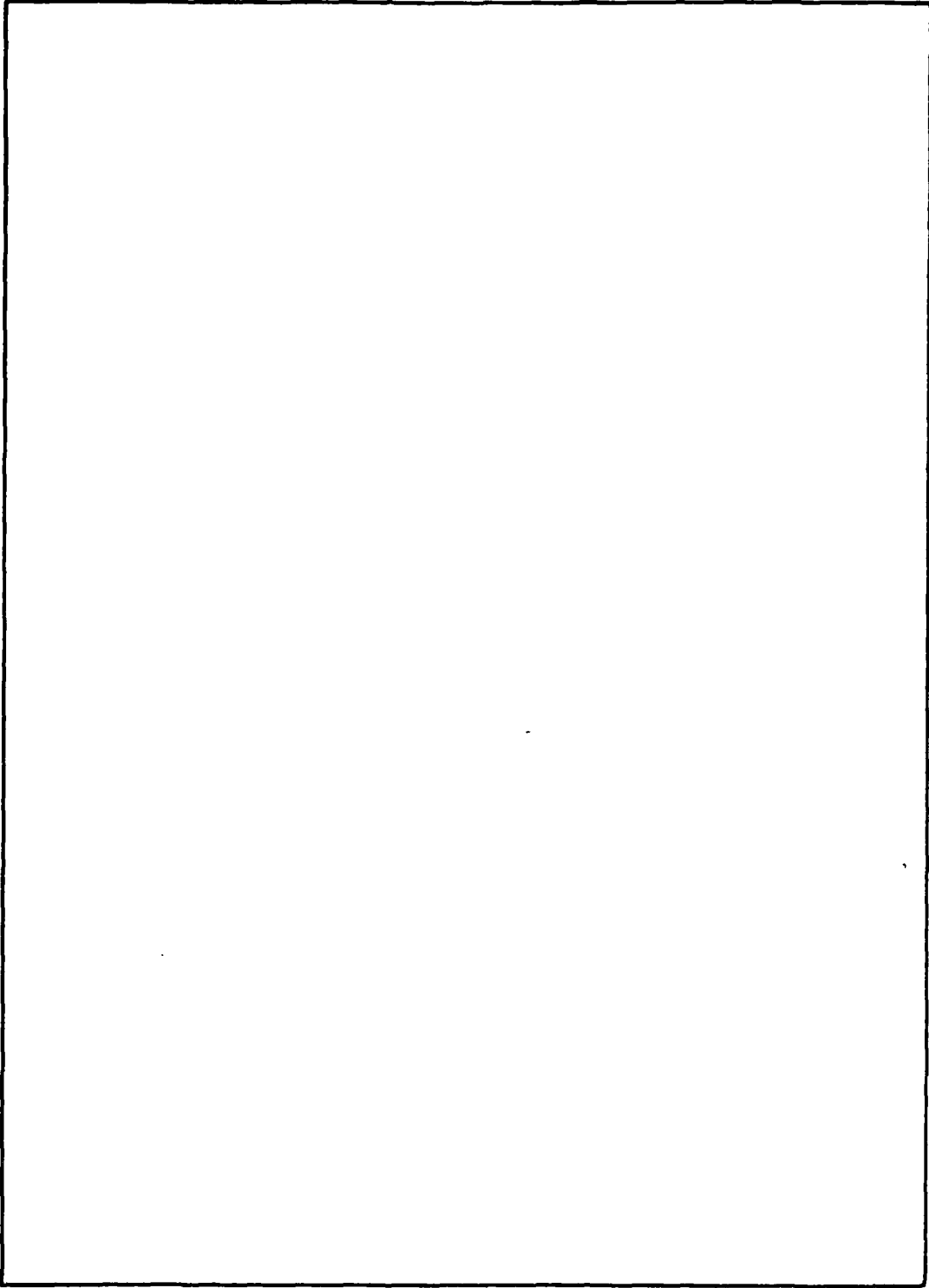
REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0274	2. GOVT ACCESSION NO. AD-A116769	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle)  DETECTING LINE-ROAD AND ROAD- INTERSECTION PATTERNS AT VARIOUS ANGLES		5. TYPE OF REPORT & PERIOD COVERED  Research Note
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) J. Robert Singleton Pi-Fuay Chen		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, VA 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS  4A161102B52C, B, 0012
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, VA 22060		12. REPORT DATE October 1981
		13. NUMBER OF PAGES 43
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report)  Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report)  Approved for Public Release; Distribution Unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)  Cartographic Feature Extraction and Recognition Solid State Sensor Array System, Walsh Transforms Minimum Distance Classifier		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) An extended Walsh transform technique for detecting and recognizing a set of cartographic features, such as linear roads and road intersections, at a variety of angles with the axes of the inspecting window is described. The method was implemented as software for an existing sensor array minicomputer system, which consists of a solid state array to convert optical images into electronic signals, a minicomputer as signal processor, and a computer-controlled translational stage as the imagery holder. Each angular orientation of the cartographic features is defined as a class of pattern and classified by using two minimum distance classifiers together with some pretesting algorithms. Typical experimental results are presented and conclusions are given.		

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)



SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

## PREFACE

This work was authorized by U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia under FY-80 DA Project-Task Area Work Unit Number 4A161102B52CB0012 entitled, "Electronic Image Analysis for Feature Extraction."

The work was done under the supervision of Dr. F. Rohde, Team Leader, Center for Theoretical and Applied Physical Sciences; and Mr. M. Crowell, Jr., Director, Research Institute.

COL Daniel L. Lycan, CE and COL Edward K. Wintz, CE were Commanders and Directors and Mr. Robert P. Macchia was Technical Director of the Engineer Topographic Laboratories during the study period.

Accession For	
NTIS GRA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Avail. and/or	
Announcement	
Part	Special
<b>A</b>	



## CONTENTS

TITLE	PAGE
PREFACE	1
ILLUSTRATIONS	3
INTRODUCTION	5
SYSTEM CONFIGURATION	6
SOFTWARE CLASSIFIER	8
THE MINIMUM DISTANCE CLASSIFIERS (MDC)	14
EXPERIMENTAL RESULTS	15
CONCLUSIONS	16
APPENDIX	
SUBROUTINE MATCH	39

## ILLUSTRATIONS

FIGURE	TITLE	PAGE
1	System Block Diagram	7
2	Input Image Array Divided Into 4 Quadrants	10
3	Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 0 Degree	17
4	Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 11.25 Degrees	18
5	Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 22.5 Degrees	19
6	Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 33.75 Degrees	20
7	Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 45 Degrees	21
8	Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 56.25 Degrees	22
9	Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 67.5 Degrees	23
10	Spatial Signature, Recognition Results, and Walsh Transform for Line Road at 78.75 Degrees	24
11	Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 90 Degrees	25
12	Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 101.25 Degrees	26
13	Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 112.5 Degrees	27



# ILLUSTRATIONS (Continued)

FIGURE	TITLE	PAGE
14	Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 123.75 Degrees	28
15	Spatial Signature, Recognition Results, and Walsh Transform for Line Road at 135 Degrees	29
16	Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 146.25 Degrees	30
17	Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 157.5 Degrees	31
18	Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 168.75 Degrees	32
19	Spatial Signature, Recognition Result, and Walsh Transform for Road Intersection at 0 Degrees	33
20	Spatial Signature, Recognition Result, and Walsh Transform for Road Intersection at 22.5 Degrees	34
21	Spatial Signature, Recognition Result, and Walsh Transform for Road Intersection at 45 Degrees	35
22	Spatial Signature, Recognition Result, and Walsh Transform for Road Intersection at 67.5 Degrees	36
23	Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 11.25 Degrees, and Translated to the Top of Window	37
24	Spatial Signature, Recognition Result, and Walsh Transform for Road Intersection at 0 Degree, and Translated to the Right of Window	38

## DETECTING LINE-ROAD AND ROAD-INTERSECTION PATTERNS AT VARIOUS ANGLES

### INTRODUCTION

Since 1979, the U.S. Army Engineer Topographic Laboratories (ETL) has been investigating discrete function technology, particularly Walsh functions, to extract and recognize a selected set of manmade cartographic features, such as road intersections, straight-line roads, and rectangular objects from aerial photographs.<sup>1,2,3,4</sup>

The Walsh transform was chosen because of its simplicity (Walsh functions are only two-valued, +1 or -1), resulting in simple implementation, and because Walsh functions conform to the selected set of cartographic features.

The technique was investigated by (1) using a 32- by 32-element, solid state sensor array to convert imagery into an electronic signal, which was processed in a minicomputer to yield the Walsh transform of the images;<sup>5,6,7</sup> and (2) using a prototype image spectrum analyzer (PISA) with a large size plasma discharge device (8.5 by 8.5 inches illuminated area with 512 electrodes each in both X and Y directions) to generate two-dimensional Walsh function patterns and produce 512 by 512 Walsh coefficients in 14 seconds.<sup>8</sup> The PISA produced successful results for a selected set of targets representing manmade cartographic features of the types stated above.

---

<sup>1</sup>P.F. Chen and W.W. Seemuller, "Signal Signatures of Topographic Features Using Analog Technology," U.S. Army Engineer Topographic Laboratories, Fort Belvoir, VA, ETL-0185, May 1979, AD-A076 110.

<sup>2</sup>P.F. Chen and W.W. Seemuller, "Application of Walsh Transforms for Topographic Feature Extraction Using a Sensor Array System," *IEEE Transactions on Instrumentation and Measurement*, pp 52-57, Vol 1M-29, March 1980.

<sup>3</sup>P.F. Chen and W.W. Seemuller, "Detection of Signal Signatures of Cartographic Features," presented at 1980 Army Science Conference, also published in the *Conference Proceedings*, West Point, NY, June 1980.

<sup>4</sup>P.F. Chen, F.W. Rohde, and W.W. Seemuller, "Prototype Image Spectrum Analyzer (PISA) for Cartographic Feature Extraction," U.S. Army Engineer Topographic Laboratories, Fort Belvoir, VA, ETL-0204, October 1979, AD-A080 729.

<sup>5</sup>P.F. Chen and W.W. Seemuller, "Signal Signatures of Topographic Features Using Analog Technology," U.S. Army Engineer Topographic Laboratories, Fort Belvoir, VA, ETL-0185, May 1979, AD-A076 110.

<sup>6</sup>P.F. Chen and W.W. Seemuller, "Application of Walsh Transforms for Topographic Feature Extraction Using a Sensor Array System," *IEEE Transactions on Instrumentation and Measurement*, pp 52-57, Vol 1M-29, March 1980.

<sup>7</sup>P.F. Chen and W.W. Seemuller, "Detection of Signal Signatures of Cartographic Features," presented at 1980 Army Science Conference, also published in the *Conference Proceedings*, West Point, NY, June 1980.

<sup>8</sup>P.F. Chen, F.W. Rohde, and W.W. Seemuller, "Prototype Image Spectrum Analyzer (PISA) for Cartographic Feature Extraction," U.S. Army Engineer Topographic Laboratories, Fort Belvoir, VA, ETL-0204, October 1979, AD-A080 729.

The sensor array minicomputer system provides a variable image threshold that results in better control of the input images. The cartographic features as described with background scenes and noise were extracted successfully from aerial imagery. Since the sensor array minicomputer system proved superior to the PISA in this application, a classifier was implemented for the former to become a semi-automated cartographic feature extraction and recognition system.<sup>9</sup>

In the referenced research, the objective was to detect road intersections and straight-line roads oriented to have 0, 45, 90, and 135 degree angles with respect to the horizontal axis of the view window only. In this report, a refined scheme is described to extend the Walsh transform processing technique to detect road intersections and straight-line roads at a variety of angles with respect to the axes of the window. The heart of the scheme was implemented as software for an existing experimental system consisting of a solid state sensor array as an opto-electronic converter, a minicomputer as a signal processor, and a computer-controlled translational stage as the imagery holder. Successful extraction and recognition results are presented for a selected set of the stated cartographic features using this experimental system. Finally, conclusions are given.

### SYSTEM CONFIGURATION

The present system configuration is shown in figure 1. A 9- by 9-inch aerial transparency, mounted on a stage translatable in both the X and Y directions, is illuminated by a d.c. - powered, white light source. A section of the transparency is then imaged onto a Reticon 32- by 32-element, solid state array sensor. The image is sampled and digitized into 1024 elements at 1024 gray levels and fed into a Hewlett-Packard (HP) 2108 minicomputer. A variable threshold is then applied to the digitized image, reducing it to a two-tone black-and-white image. The white pixels are assigned the value 100, and the black elements are assigned 0. This two-valued image is then transformed to generate a two-dimensional Walsh transform coefficient matrix composed of 32 by 32 elements. The low order, 16 by 16 coefficients are then applied to the software classification algorithm, which will be described later. This algorithm classifies the image into 1 of 16 angles for straight-line roads or into 1 of 4 angles of road intersections, or "not recognized" if the image does not fit either classification.

---

<sup>9</sup>P.F. Chen and W.W. Seemuller, "Detection of Signal Signatures of Cartographic Features," Presented at 1980 Army Science Conference, also published in the *Conference Proceedings*, West Point, NY, June 1980.

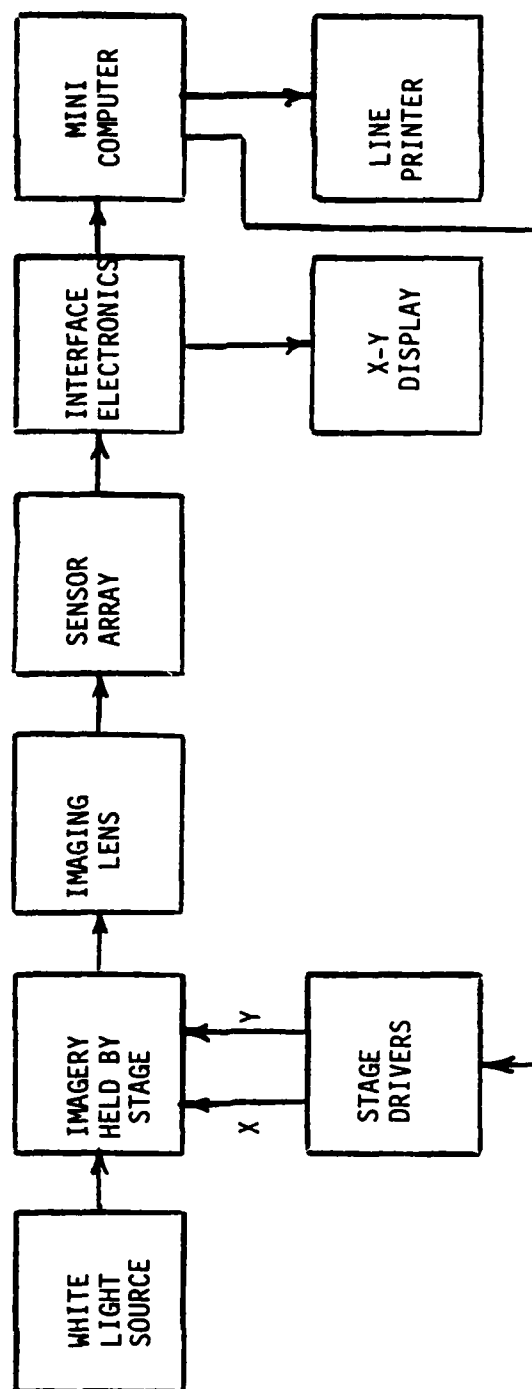


FIGURE 1. System Block Diagram.

## SOFTWARE CLASSIFIER

Two arrays are passed to the software classification subroutine: the Walsh transform coefficient matrix (IXFRM) and the post-threshold image matrix. First, line roads are separated from road intersections to form two independent large cases.

To differentiate between line roads and intersections, one must summarize the first 8 rows and 8 columns of the transform matrix, such that

$$C_j = \sum_{i=1}^{16} T(i, j) \quad R_i = \sum_{j=1}^{16} T(i, j)$$

where

$T(i, j)$  is the  $i$  th row and  $j$  th column element of the Walsh coefficient matrix.

These summations are then used as the first step in differentiating between line roads and intersections by using the formula

$$A = \frac{|C_1 - T(1, 1)|}{|T(1, 1)|}, \quad B = \frac{|R_1 - T(1, 1)|}{|T(1, 1)|}$$

If  $A > 0.7$ ,  $B > 0.7$ ,  $C_1 \geq 50$ , and  $R_1 \geq 50$ , then the image is defined as a road intersection.

This test will recognize an intersection for all cases, except one. When an intersection is aligned at 45 degrees to the viewing axis, another test must be made. From the image and Walsh transform of an intersection oriented at 45 degrees, it can be observed that  $R_1$  and  $C_1$  are both rather small in magnitude (both less than 50, which was the minimum value for an image to be classified as an intersection in the last test). However, the sum of diagonal transform coefficients [ $T(1, 1) + T(2, 2) + \dots + T(16, 16)$ ] is a reasonably large quantity.

With the sum of the first five diagonal coefficients defined as

$$D = \sum_{i=j=1}^5 T(i, j).$$

an image is recognized as an "intersection at 45 degrees" if one of the following expressions is met:

$$\text{If } \frac{|T(2, 3)|}{|T(1, 1)|} > 0.35 \text{ AND } \frac{|T(2, 2)|}{|T(1, 1)|} < 0.3 \text{ AND } T(2, 3) + T(1, 1) > 40$$

OR

$$\frac{|T(3, 2)|}{|T(2, 3)|} > 0.35 \text{ AND } \frac{|T(2, 2)|}{|T(1, 1)|} < 0.3 \text{ AND } T(1, 1) + T(3, 2) > 40$$

OR

$$D > 40 \text{ AND } \frac{|T(3, 3)|}{|T(1, 1)|} > 0.35 \text{ AND } \frac{|T(2, 2)|}{|T(1, 1)|} < 0.3;$$

The above tests in combination with a minimum distance classifier will effectively detect 0 and 45 degree angles. However, another test is necessary, and that one is performed in the image domain.

Let

$$C = \sum_{m=1}^{32} A(1, m) \quad D = \sum_{n=1}^{32} A(32, n)$$

where  $A(1, m)$  and  $A(32, n)$  with  $m, n = 1, 2, \dots, 32$  are the 1st and 32nd rows of the input pattern in the image domain. Increment  $m$  and  $n$ , and compute  $C$  and  $D$  until  $C = D = 300$ . Then, if  $n > m$ , the image is at a 22.55 degree angle, and if  $m > n$ , it is at 67.5 degrees.

The algorithm for determining the angle of line roads will be discussed next. The image can be divided into four quadrants (see figure 2).

## QUADRANTS

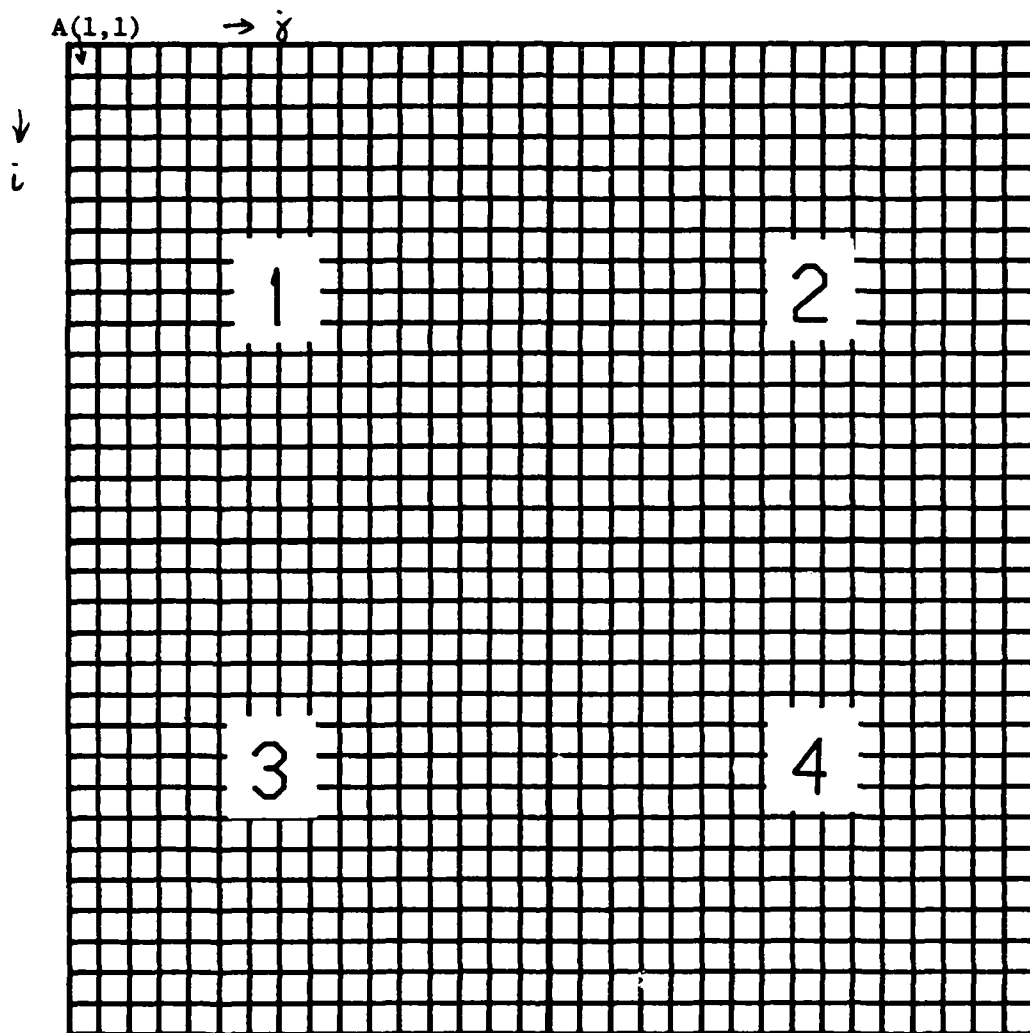


FIGURE 2. Input Image Array Divided Into 4 Quadrants.

Let

$$M_1 = \sum_{i=1}^{16} \sum_{j=1}^{16} A(i,j)$$

$$M_2 = \sum_{i=1}^{16} \sum_{j=17}^{32} A(i,j)$$

$$M_3 = \sum_{i=17}^{32} \sum_{j=1}^{16} A(i,j)$$

$$M_4 = \sum_{i=17}^{32} \sum_{j=17}^{32} A(i,j)$$

where  $A(i,j)$  is the input image array.

Several tests are then applied to determine whether the angle of the image lies (a) between 0 and 90 degrees, or (b) between 90 and 180 degrees.

#### TEST 1

If  $M_1 = 0$ , and  $M_2$ ,  $M_3$ , and  $M_4$  do not equal 0, then the angle is less than 90 degrees.

If  $M_2 = 0$ , and  $M_1$ ,  $M_3$ , and  $M_4$  do not equal 0, then the angle is between 90 and 180 degrees.

If  $M_3 = 0$ , and  $M_1$ ,  $M_2$ , and  $M_4$  do not equal 0, then the angle is between 90 and 180 degrees.

If  $M_4 = 0$ , and  $M_1$ ,  $M_2$ , and  $M_3$  do not equal 0, then the angle is less than 90 degrees.

If the angle of the image falls into one of the above categories, the routine then proceeds to the Minimum Distance Classifier (MDC). Otherwise, it proceeds to TEST 2.



## TEST 2

- (A) If  $M_1 = M_2 = 0$ , and  $M_3$  and  $M_4$  do not equal 0, then compute  $M_3$  and  $M_4$  until  $M_3 = M_4 = 1000$ , where

$I_{M_3}$  is the net increment of the subscript used for the outer summation to compute  $M_3$  to produce a sum of 1000.

$I_{M_4}$  is similar to  $I_{M_3}$ , but for  $M_4$

If  $I_{M_3} \geq I_{M_4}$ , the angle is less than or equal to 90 degrees.

$I_{M_3} < I_{M_4}$ , the angle is between 90 and 180 degrees.

Proceed to the MDC routine.

- (B) If  $M_3 = M_4 = 0$ , and  $M_1$  and  $M_2$  do not equal 0, then compute  $M_1$  and  $M_2$  until  $M_1 = M_2 = 1000$ , where  $I_{M_1}$  and  $I_{M_2}$  are similar to those (A) above.

If  $I_{M_1} \geq I_{M_2}$ , the angle is less than or equal to 90 degrees.

$I_{M_1} < I_{M_2}$ , the angle is between 90 and 180 degrees.

Proceed to the MDC routine.

If neither of the conditions in (A) or (B) were true, then do TEST 3.

### TEST 3

- (A) If  $M_1 = M_3 = 0$ ,  $M_2$  and  $M_4$  do not equal 0, then compute  $M_2$  and  $M_4$  until  $M_2 = M_4 = 1000$ . Let  $J_{M_2}$  and  $J_{M_4}$  be the net increment of the subscript used to compute  $M_2$  and  $M_4$  respectively.

If  $J_{M_2} \geq J_{M_4}$ , the angle is less than or equal to 90 degrees.

If  $J_{M_2} < J_{M_4}$ , the angle is between 90 and 180 degrees.

Proceed to MDC routine.

- (B) If  $M_2 = M_4 = 0$ , and  $M_1$  and  $M_3$  do not equal 0, then compute  $M_1$  and  $M_3$  until  $M_1 = M_3 = 1000$ , where  $J_{M_1}$  and  $J_{M_3}$  are similar to those in (A).

If  $J_{M_1} \geq J_{M_3}$ , the angle is less than or equal to 90 degrees.

If  $J_{M_1} < J_{M_3}$ , the angle is between 90 and 180 degrees.

Proceed to the MDC routine.

### TEST 4

This test is performed if each of the four quadrants contains at least one white pixel.

If  $M_1 = 0$ ,  $M_2 = 0$ ,  $M_3 = 0$ , or  $M_4 = 0$ , then proceed to TEST 5.

If  $T(2, 2) < 0$ , the image is less than 90 degrees.

If  $T(2, 2) > 0$ , the image is greater than 90 degrees.

Proceed to the MDC routine.

## TEST 5

If  $M_1$  does not equal 0, and  $M_2 = M_3 = M_4 = 0$ ,  
then the angle is less than 90 degrees.

If  $M_4$  does not equal 0, and  $M_1 = M_2 = M_3 = 0$ ,  
then the angle is less than 90 degrees.

If  $M_2$  does not equal 0, and  $M_1 = M_3 = M_4 = 0$ ,  
then the angle is between 90 and 180 degrees.

If  $M_3$  does not equal 0, and  $M_1 = M_2 = M_4 = 0$ ,  
then the angle is between 90 and 180 degrees.

Proceed to the MDC routine.

If the image has not passed any of the above tests, then it is classified as "not recognized."

## THE MINIMUM DISTANCE CLASSIFIERS (MDC)

Separate minimum distance classifiers (MDC) were designed for both linear-road patterns and road-intersection patterns respectively. The set of linear-line roads consists of 16 classes, and each class represents a linear road oriented at a particular angle with respect to the axes of the inspecting window. Likewise, the set of road intersections consisted of four classes. Assuming that these classes are representable by prototype (or reference) patterns  $\underline{z}_1, \underline{z}_2, \dots, \underline{z}_m$ , then for linear roads,  $m = 16$  and for road intersections,  $m = 4$ .

The Eclidean distance between an arbitrary pattern vectors  $\underline{x}$  and the  $i$ th prototype is given by

$$D_i = ||\underline{x} - \underline{z}_i|| = \sqrt{(\underline{x} - \underline{z}_i)^T (\underline{x} - \underline{z}_i)},$$

where

$(\underline{x} - \underline{z}_i)^T$  is the transpose of  $(\underline{x} - \underline{z}_i)$ .

A minimum distance classifier computes the distance from a pattern  $\underline{X}$  of unknown classification to the prototype of each class and assigns the pattern to the class to which it is closest. In other words,  $\underline{X}$  is assigned to class "i" if  $D_i < D_j$  for all  $j \neq i$ .

To establish the prototypes  $\underline{z}_1, \underline{z}_2, \dots, \underline{z}_m$ , one should use the first 8 rows and 8 columns of the summarized Walsh transform coefficients,  $R_1, R_2, \dots, R_8, C_1, C_2, \dots, C_8$ , as measurement vectors. They are expressed as

$$\underline{z}_i = [R_{1i}, R_{2i}, \dots, R_{8i}, C_{1i}, C_{2i}, \dots, C_{8i}]^T$$

Sixteen prototypes for linear roads having incremental angles of 11.25 degrees (starting at 0 degree with respect to the horizontal axis of the window) were obtained using the above equation. Likewise, four prototypes for road intersections at angles of 0, 22.5, 45.0, and 67.5 degrees with respect to the horizontal axis of the window were computed. These  $\underline{z}_i$  were then used to compute  $D_i$  and classify the incoming unknown pattern,  $\underline{X}$ . The complete software package for this method is attached in the appendix.

## EXPERIMENTAL RESULTS

Targets representing linear roads and road intersections at various angles with respect to the axes of the window were constructed on a glass plate. The targets were used as input test images. The glass plate was mounted on a computer-controlled translational stage so that the relative position of the images against the surface of the solid state array can be adjusted arbitrarily.

In figures 3 through 18, the original images in spatial domain, the recognition results, and the Walsh transforms for linear roads at a variety of orientation with the window are shown. The experimental results for road intersections having various angles with the axes of the window are shown in figures 19 through 22. Correct recognition was obtained for all cases.

A random translation of these images against the window was also tested. It was discovered that for the well-defined images, such as targets used for this experimentation, no misclassification was obtained. In figures 23 and 24, the typical test results for a linear road and a road intersection translated away from their center position. Again correct recognition was obtained for both cases. Other tests for translation were performed and similar results were obtained.

The detectable angular resolutions for the line roads and the road intersections were found to be 11.25 and 22.5 degrees, respectively. When the test images were corrupted by a large amount of noise, the method failed to produce correct recognition results. The amount of noise may be reduced by thinning techniques. However, the thinning techniques were not tested during the experiments.

## CONCLUSIONS

1. Noise-free linear cartographic features, such as roads and road intersections at a variety of angles with the axes of the inspecting window, can be detected using an extended Walsh transform processing technique.
2. Minimum distance classifiers together with some pretesting conditions were found to be very suitable for this application.
3. All the test images (targets) at a variety of angles and also with arbitrary translations were detected and classified correctly.
4. The detectable angular resolutions for linear roads and road intersections were found to be 11.25 and 22.5 degrees, respectively.

WED JUN 11 1980 14:20

INPUT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
14	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	
15	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
16	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
17	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
18	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

LINE ROAD AT 0.00 DEGREE  
WED JUN 11 1980 14:22

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12

FIGURE 3. Spatial Signaturc, Recognition Result, and Walsh Transform  
for Line Road at 0 Degree.

## INPUT

[illegible]

LINE ROAD AT 11.25 DEGREES  
WED JUN 11 1980 14126

**TRAVEL**

[illegible]

**FIGURE 4. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 11.25 Degrees.**

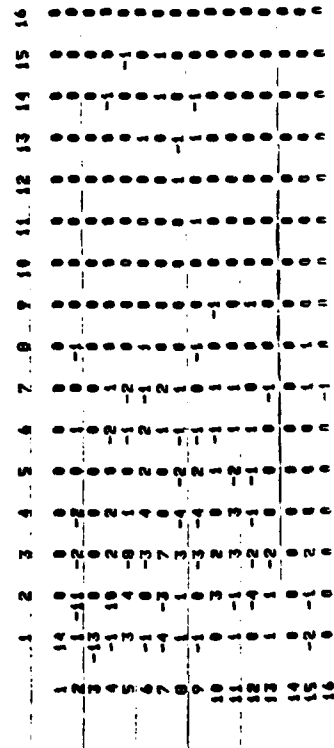
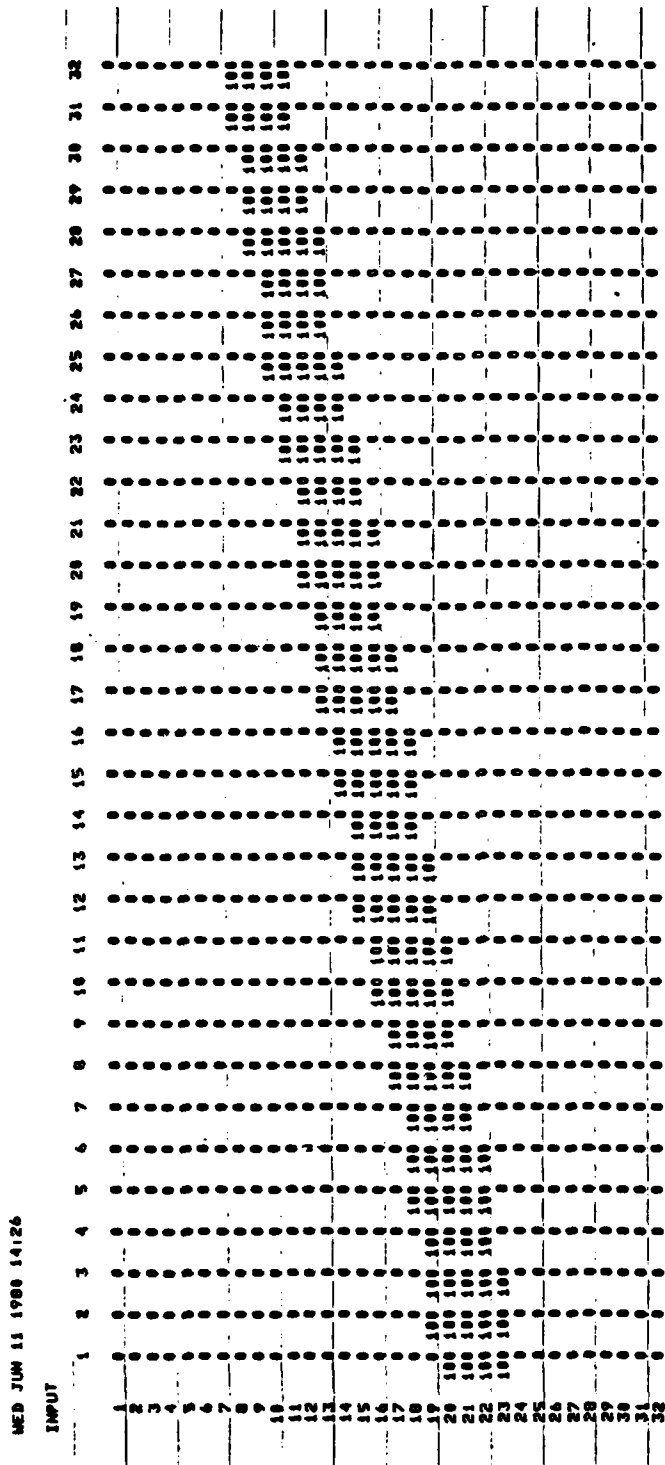


FIGURE 5. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 22.5 Degrees.



1 MED JUN 11 1988 14:27

INPUT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 33.75 DEGREES  
MED JUN 11 1988 14:28

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	3	-14	-2	-4	2	2	-2	-2	0	0	0	0	0	0	-1	-1
3	0	-4	0	-4	2	0	3	-1	0	0	0	0	0	0	1	0
4	2	-4	0	-4	-2	-4	3	-1	0	0	-1	0	0	-1	1	0
5	-2	4	-7	-4	2	-4	-2	-1	0	0	1	0	1	-2	-1	-1
6	-1	4	1	4	4	0	0	1	0	0	0	0	2	0	0	1
7	-3	-2	3	5	-1	1	2	0	0	0	0	-2	0	0	1	0
8	1	0	-2	0	-2	0	2	0	0	0	-1	0	0	0	0	0
9	0	1	0	-1	0	3	0	1	0	-1	0	1	0	0	0	0
10	0	1	0	0	-4	0	0	0	0	0	0	-1	0	0	0	0
11	1	0	0	4	-1	0	0	0	0	0	0	0	0	0	0	0
12	-1	-2	-3	1	2	-1	-1	0	0	0	0	0	0	-1	0	0
13	-1	2	-3	-2	1	-1	-1	0	0	0	0	0	0	0	0	0
14	0	2	0	2	1	-1	0	1	0	-1	0	0	1	0	0	0
15	-2	-1	1	1	-1	1	0	0	0	0	0	-1	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 6. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 33.75 Degrees.

WED JUN 11 1980 14:29

INPUT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 45.00 DEGREE  
WED JUN 11 1980 14:29

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	31	1	2	0	2	0	2	0	0	0	0	0	0	0	0	0
2	8	25	-2	-3	0	7	-1	-2	0	1	0	0	0	0	0	-1
3	-3	-3	19	0	-2	2	7	0	0	0	-2	0	1	3	0	0
4	0	-2	1	-13	-3	-2	0	-2	0	0	0	3	-2	-1	0	-1
5	-2	0	-2	3	0	0	-1	0	0	0	0	1	3	0	0	0
6	0	7	2	-2	0	-4	0	-1	0	0	0	0	0	-2	0	0
7	-2	-1	7	0	-1	0	0	0	-1	0	0	-1	0	0	1	0
8	0	-2	0	-2	0	-1	0	2	3	0	0	0	0	0	0	0
9	0	0	0	0	0	0	-1	0	3	-3	0	0	0	0	0	0
10	0	1	0	0	0	0	0	-1	0	1	1	0	0	0	0	0
11	0	0	-2	0	1	0	0	0	-1	0	1	0	0	0	0	0
12	0	0	0	0	3	1	0	0	0	0	0	-1	0	0	0	0
13	0	0	0	0	-1	3	0	0	0	0	0	0	1	0	0	0
14	0	3	1	-1	0	-2	0	0	0	0	-1	0	0	0	-1	0
15	0	0	3	0	0	0	0	1	0	0	0	0	0	0	0	0
16	0	-1	0	0	-1	0	0	0	0	0	0	0	0	0	0	0

FIGURE 7. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 45 Degrees.



WED JUN 11 1988 14:31

INPUT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 67.59 DEGREES  
WED JUN 11 1988 14:31

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	12	0	-12	0	1	0	-2	0	0	-1	0	1	0	1	0	-1
2	0	-11	0	10	-1	0	0	0	0	0	3	0	-3	0	0	0
3	0	0	0	0	-8	0	0	0	-2	-1	3	0	-2	0	0	2
4	0	-1	0	1	0	6	0	-6	1	1	-1	-1	0	0	0	0
5	0	0	0	0	-1	-1	0	1	5	0	-4	0	1	0	-1	0
6	0	1	0	-2	0	3	0	-2	0	-3	0	2	0	0	0	0
7	0	0	0	-1	-3	0	2	0	0	0	0	-2	0	1	0	0
8	0	-2	0	0	1	0	0	-1	0	-1	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	-1	0	0	0	0	0	-1	0	0	0
12	0	0	0	0	0	0	0	0	2	-1	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0
14	0	0	0	0	-1	0	1	0	0	0	0	1	0	0	0	0
15	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

FIGURE 9. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 67.5 Degrees.

WED JUN 11 1988 14:31

INPUT

1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 78.75 DEGREES  
WED JUN 11 1988 14:32

TRANSFORM

1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	14	1	-14	-1	11	0	-11	0	1	-1	-1	1	3	0	-3	0
2	0	0	0	0	1	-6	-1	6	3	2	-3	-2	1	0	-1	0
3	0	-1	0	1	-2	-2	2	-5	0	5	0	-2	0	0	2	0
4	0	-3	0	3	1	-1	1	0	1	0	-1	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	1	0	-1	0
6	0	0	0	0	0	1	0	-1	0	0	0	0	0	0	-1	0
7	0	0	0	0	-1	0	1	0	-1	0	0	0	0	0	0	0
8	0	-2	0	2	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 10. Spatial Signature, Recognition Results, and Walsh Transform  
for Line Road at 78.75 Degrees.

WED JUN 11 1988 14:32

INPUT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 90.00 DEGREES

WED JUN 11 1988 14:33

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	16	-2	-16	2	16	-2	-16	2	0	2	-9	-2	0	2	-9	-2
2	-1	-1	1	1	-1	-1	1	1	1	-1	-1	1	1	-1	-1	1
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 11. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 90 Degrees.

## INPUT

[illegible]

LINE ROAD AT 101.25 DEGREES  
WED JUN 11 1900 14134

## TRANSFORM

[illegible]

**FIGURE 12. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 101.25 Degrees.**

WED JUN 11 1980 14:34

INPUT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 112.50 DEGREES

WED JUN 11 1980 14:34

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	14	-1	-14	0	3	1	-4	0	-1	0	1	0	1	0	-2	0
2	0	11	0	-11	1	1	-1	0	-4	0	4	0	3	1	2	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	2	0	-2	0	-6	0	5	-1	-1	1	2	0	0	0	0
5	0	0	0	-1	0	1	0	4	0	-3	0	0	0	-1	0	0
6	-1	0	2	0	-3	0	3	0	2	0	-1	0	-1	0	0	0
7	0	2	0	-1	-3	0	1	0	0	0	-1	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 13. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 112.5 Degrees.



WED JUN 11 1980 14:35

INPUT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 123.75 DEGREES

WED JUN 11 1980 14:35

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	14	-4	-4	-2	-1	2	-2	0	-1	0	0	1	0	1	-1	0
2	0	11	-4	-3	-5	-5	-2	1	1	-2	0	1	2	-1	-1	0
3	0	3	4	-9	-4	-1	2	-2	-2	0	0	4	-1	0	1	0
4	0	4	-5	2	-4	0	6	-1	-1	-1	5	-1	0	0	0	0
5	0	-2	0	2	1	-6	1	2	-2	4	0	-1	0	0	0	0
6	0	-2	0	2	-5	0	-3	3	-1	0	-1	-1	0	0	0	0
7	0	1	2	-2	-1	0	2	-2	1	0	-2	1	0	0	0	0
8	0	0	1	0	0	-2	0	0	1	0	0	-1	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	-1
11	0	0	0	0	1	0	0	-1	2	0	-1	0	0	0	0	0
12	0	0	0	0	1	0	0	-2	1	1	1	0	0	0	-2	0
13	0	0	0	0	1	0	0	1	0	1	1	0	0	0	0	0
14	0	-1	0	1	-2	0	0	1	0	0	0	-1	0	0	0	0
15	0	1	0	-1	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 14. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 123.75 Degrees.



WED JUN 11 1988 14:37

INPUT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 146.25 DEGREES  
WED JUN 11 1988 14:37

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	-1	13	2	2	-1	-2	1	2	0	-1	0	0	0	0	0	0
3	-7	-3	9	-2	3	0	4	-1	0	0	0	0	0	0	0	0
4	-1	-4	-4	6	2	0	-1	1	0	0	0	0	0	0	0	0
5	-3	2	-9	-3	4	-2	-3	-1	0	0	0	0	0	0	0	0
6	0	0	-1	-7	-4	2	0	0	0	0	0	0	0	0	0	0
7	-3	-1	3	3	-5	0	1	-1	0	0	0	0	0	0	0	0
8	0	0	1	0	0	1	-3	-2	0	0	0	0	0	0	0	0
9	0	1	1	0	0	3	0	1	-1	0	0	0	0	0	0	0
10	0	-1	0	2	3	0	1	-1	0	0	0	0	0	0	0	0
11	0	0	-1	1	-3	-1	0	-1	0	0	0	0	0	0	0	0
12	0	1	1	-4	-1	-2	0	-1	0	0	0	0	0	0	0	0
13	-1	1	-4	-1	1	-1	-1	0	0	0	0	0	0	0	0	0
14	0	-2	0	-2	-1	0	0	0	0	0	0	0	0	0	0	0
15	-1	0	1	0	1	-1	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 16. Spatial Signature, Recognition Result, and Walsh Transform  
for Line Road at 146.25 Degrees.

WED JUN 11 1988 14:37

INPUT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
10	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
11	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
12	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
13	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
14	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
15	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
16	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
17	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
18	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
19	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
20	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
21	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
22	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
23	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
24	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
25	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
26	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
27	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
28	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
29	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
30	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
31	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
32	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

LINE ROAD AT 157.50 DEGREES  
WED JUN 11 1988 14:38

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	-1	10	1	2	0	-1	1	0	0	0	0	0	0	0	0	0
3	-12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	8	-10	-2	-1	0	2	-2	0	0	0	0	0	0	0	0	0
5	2	2	0	0	0	0	-1	0	0	0	0	0	0	0	0	0
6	1	0	2	-5	-2	-2	1	-1	0	0	0	0	0	0	0	0
7	-2	-2	7	3	3	2	2	1	0	0	0	0	0	0	0	0
8	0	0	0	-1	5	3	1	0	0	0	0	0	0	0	0	0
9	-1	0	-2	-4	-1	2	0	0	0	0	0	0	0	0	0	0
10	0	-3	-3	0	-1	2	0	0	0	0	0	0	0	0	0	0
11	1	0	2	3	-3	0	1	0	0	0	0	0	0	0	0	0
12	0	3	2	0	0	-2	0	0	0	0	0	0	0	0	0	0
13	0	1	-2	0	0	0	-1	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	-1	-1	2	0	-1	0	1	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 17. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 157.5 Degrees.

MED JUN 11 1988 14:38

INPUT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINE ROAD AT 168.75 DEGREES

MED JUN 11 1988 14:39

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	-6	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0
3	-15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	-6	-1	-3	0	0	0	0	0	0	0	0	0	0	0	0	0
5	10	-4	-2	0	0	0	0	0	0	0	0	0	0	0	0	0
6	-1	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0
7	-10	-4	2	-2	0	0	0	0	0	0	0	0	0	0	0	0
8	1	-3	-4	0	0	0	0	0	0	0	0	0	0	0	0	0
9	1	-3	-4	0	0	0	0	0	0	0	0	0	0	0	0	0
10	2	-3	-2	0	0	0	0	0	0	0	0	0	0	0	0	0
11	9	-5	2	-1	0	0	0	0	0	0	0	0	0	0	0	0
12	-2	3	0	2	-1	0	0	0	0	0	0	0	0	0	0	0
13	4	2	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	-1	1	0	0	0	0	0	0	0	0	0	0	0	0
15	-4	-2	1	0	1	0	0	0	0	0	0	0	0	0	0	0
16	0	0	1	1	-1	0	0	0	0	0	0	0	0	0	0	0

FIGURE 18. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 168.75 Degrees.

WED JUN 11 1988 14142

INPUT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

INTERSECTION AT 0.00 DEGREES  
WED JUN 11 1988 14143

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	40	0	-21	-2	16	0	-16	0	0	-2	0	2	0	-3	0	0
2	0	-2	3	1	-1	3	1	-2	3	0	-2	0	0	-2	0	2
3	-15	3	-3	0	5	-1	-4	0	0	0	0	0	0	0	0	0
4	-3	1	0	-1	1	0	3	0	0	0	0	0	0	0	0	0
5	13	0	4	-1	-3	0	0	0	0	0	0	0	0	0	0	0
6	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
7	-13	1	-4	1	3	0	-3	0	0	0	0	0	0	0	0	0
8	-1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
9	2	2	3	0	0	-1	1	0	0	0	0	0	0	0	0	0
10	-3	1	0	0	0	-1	0	0	0	0	0	0	0	0	0	0
11	-2	-3	-2	0	0	1	0	0	0	0	0	0	0	0	0	0
12	3	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0
13	5	0	1	1	-1	0	1	0	0	0	0	0	0	0	0	0
14	0	0	-2	0	0	0	0	0	0	0	0	0	0	0	0	0
15	-5	0	-1	-1	1	0	-1	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 19. Spatial Signature, Recognition Result, and Walsh Transform for Road Intersection at 0 Degrees.

[illegible][illegible]

**FIGURE 20. Spatial Signature, Recognition Result, and Walsh Transform for Road Intersection at 22.5 Degrees.**

WED JUN 11 1980 14:47

INPUT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
2	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
3	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
4	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
5	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
6	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
7	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
8	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
9	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
10	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
11	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
12	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
13	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
14	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
15	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
16	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
17	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
18	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
19	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
20	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
21	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
22	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
23	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
24	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
25	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
26	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
27	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
28	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
29	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
30	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
31	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
32	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

INTERSECTION AT 45.00 DEGREES  
WED JUN 11 1980 14:48

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	36	2	0	-5	-5	0	0	-3	0	0	0	0	1	-2	0	0
2	3	-2	-3	-1	-1	0	0	0	0	0	0	0	0	0	0	0
3	0	0	21	-3	1	-11	5	0	0	1	0	0	0	0	0	0
4	3	3	1	-8	-3	-2	0	0	0	0	0	0	0	0	0	0
5	-5	0	-1	13	9	-1	2	-1	0	0	0	0	0	0	0	0
6	0	0	5	2	-4	-7	1	0	0	2	-3	0	0	0	0	0
7	0	4	5	0	-1	2	4	1	0	-2	0	0	0	0	0	0
8	1	1	0	0	0	-1	-3	-4	-1	1	0	0	0	0	0	0
9	0	0	0	0	0	1	0	2	-1	2	-1	0	0	0	0	0
10	0	1	0	0	0	3	1	-2	-1	2	0	0	0	0	0	0
11	0	0	-3	1	0	-4	0	1	1	-1	0	0	0	0	0	0
12	0	-1	1	3	3	-1	0	0	0	0	-1	0	0	0	0	0
13	-1	0	0	5	4	0	0	0	0	0	0	0	0	0	0	0
14	0	0	2	0	0	-2	0	0	0	0	0	0	0	0	0	0
15	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 21. Spatial Signature, Recognition Result, and Walsh Transform for Road Intersection at 45 Degrees.



WED JUN 11 1980 14:49

INPUT

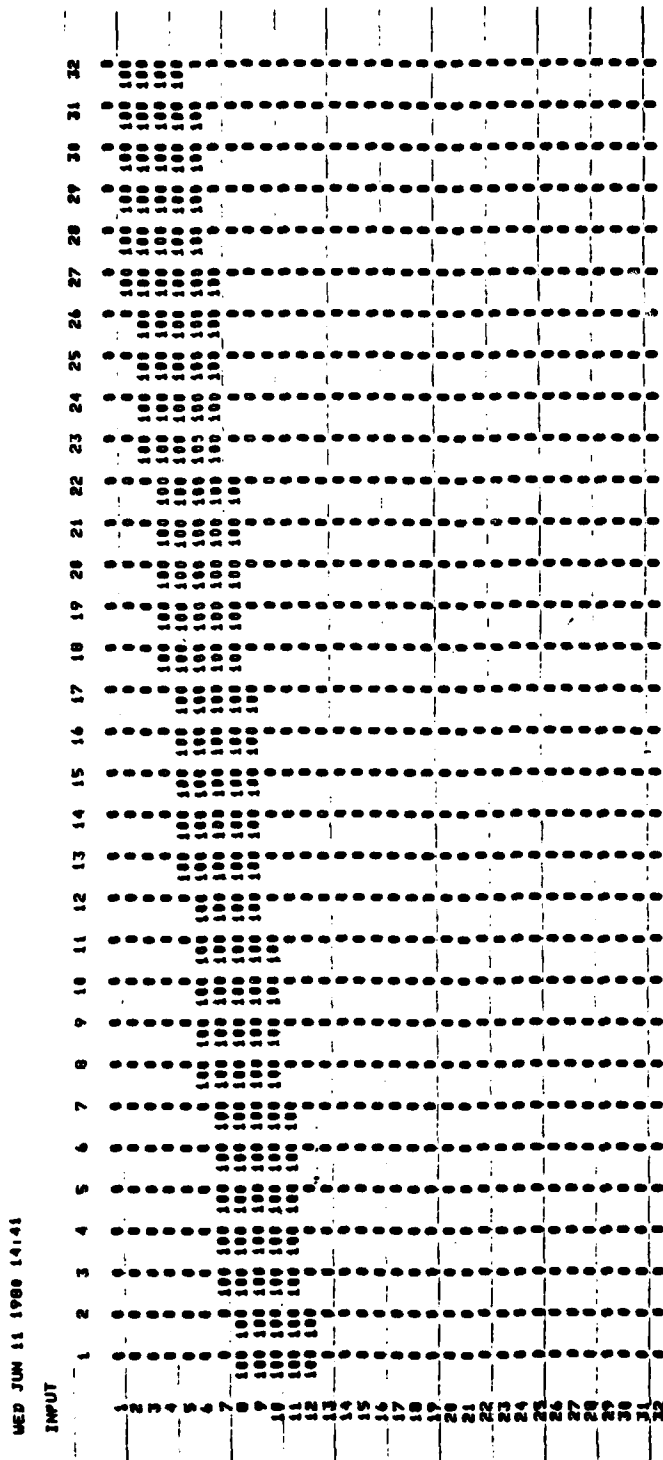
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

INTERSECTION AT 67.58 DEGREES  
WED JUN 11 1980 14:49

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	29	-7	-9	6	-2	4	-2	-1	0	0	1	-2	0	1	-1	0
2	18	2	-3	0	-7	1	2	-2	-1	0	3	-1	-2	0	0	0
3	-12	0	4	-4	-1	7	0	-1	2	-1	0	0	0	2	1	0
4	-1	-15	5	0	-4	5	2	-1	0	0	0	0	-2	3	1	1
5	-2	1	-4	-4	-1	2	-4	-1	-1	0	1	0	0	0	0	0
6	-1	-3	0	0	0	-2	-1	0	2	-1	-2	2	3	-2	-2	0
7	0	0	0	-1	-1	0	1	0	0	-1	-2	3	0	-1	1	0
8	-1	0	0	1	5	-3	0	1	1	0	0	0	0	0	0	-1
9	-2	1	1	0	4	0	0	0	0	0	0	0	1	0	1	0
10	0	-2	1	1	0	3	0	1	0	0	0	0	0	2	0	0
11	4	0	0	1	-2	0	0	1	0	-1	0	-2	0	1	0	0
12	0	5	0	0	2	-2	0	0	0	-1	0	1	0	0	0	0
13	0	0	-2	-2	0	1	0	0	-1	0	0	0	0	0	0	0
14	-1	1	0	-3	0	-1	0	1	0	-1	0	0	0	0	-1	0
15	-1	0	2	0	-1	0	-1	0	1	0	0	1	-1	0	0	0
16	0	-1	0	0	0	-1	0	-1	1	0	0	0	0	0	0	-1

FIGURE 22. Spatial Signature, Recognition Result, and Walsh Transform for Road Intersection at 67.5 Degrees.



LINE ROAD AT 11.25 DEGREES  
WED JUN 11 1988 14:42

TRANSFORM

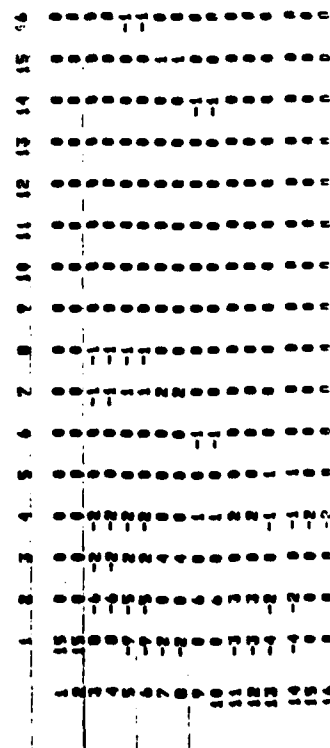


FIGURE 23. Spatial Signature, Recognition Result, and Walsh Transform for Line Road at 11.25 Degrees, and Translated to the Top of Window.

WED JUN 11 1988 14:43

INPUT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

INTERSECTION AT 0.00 DEGREES  
WED JUN 11 1988 14:44

TRANSFORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	40	-23	-10	10	0	0	0	1	0	-1	6	-7	7	-1	1	
2	12	4	5	-4	0	-1	2	-1	-1	1	-2	2	2	-1	-1	
3	-6	-1	1	0	-1	0	2	-1	0	0	0	0	0	0	0	
4	-4	-1	1	0	-1	0	2	-1	0	0	0	0	0	0	0	
5	-13	-3	-4	3	-1	2	0	0	1	0	1	-1	1	0	0	
6	-14	-2	-4	3	-2	0	0	0	1	0	1	-1	1	0	0	
7	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	
8	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	
9	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	
10	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	
11	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
12	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
13	-2	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	
14	-3	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	
15	-2	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	
16	-2	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	

FIGURE 24. Spatial Signature, Recognition Result, and Walsh Transform for Road Intersection at 0 Degree, and Translated to the Right of Window.

**APPENDIX**  
**SUBROUTINE MATCH**

FTN4,L

```
SUBROUTINE MATCH (IXFRM,CONS,LUOT,INBUF)
DIMENSION IXFRM(1024),CONS(20,16),COLM(16),INBUF(1024)
ITOT=0
DO 20 J=1,8
  ISUM=0
  DO 10 I=1,16
    10 ISUM=ISUM+IABS(IXFRM((I-1)*16+J))
    COLM(J)=ISUM
  20 ITOT=ITOT+ISUM
  DO 28 J=9,16
    ISUM=0
    DO 26 I=1,16
      26 ISUM=ISUM+IABS(IXFRM((J-9)*16+I))
      COLM(J)=ISUM
    28 ITOT=ITOT+ISUM
C
C SEE IF INTERSECTION
C
  A=ABS(COLM(1)-IXFRM(1))/IABS(IXFRM(1))
  B=ABS(COLM(9)-IXFRM(1))/IABS(IXFRM(1))
  IF (A.GT.0.7 .AND. B.GT.0.7 .AND. COLM(1).GE.50.
    * .AND. (COLM(9).GE.50)) GOTO 800
C
C COMPUTE DIAGONAL
C
  IDIAG=0
  DO 900 I=1,5
    900 IDIAG=IDIAG+IXFRM((I-1)*16+I)
    AT1=IABS(IXFRM(19))
    AT2=IABS(IXFRM(18))
    AT3=IABS(IXFRM(34))
    AT4=IABS(IXFRM(35))
    AT5=IABS(IXFRM(1))
    IF (((AT1/AT5).GT.0.35 .AND. (AT2/AT5).LT.0.3 .AND.
      * (AT5+AT1).GT.40)
      *.OR. ((AT3/AT1).GT.0.35 .AND. (AT2/AT5).LT.0.3 .AND. (AT5+AT3)
      *.GT.40) .OR. (IDIAG.GT.40 .AND. (AT4/AT5).GT.0.35 .AND.
      *(AT2/AT5).LT.0.3)) GOTO 810
C
C
C COMPUTE QUADRANTS TO DETERMINE IF ANGLE IS LESS THAN 90 DEGREES
C OR IF IT IS BETWEEN 90 AND 180 DEGREES
C
C
  M1=0
  M2=0
  DO 120 I=0,15
    DO 100 J=1,16
      100 M1=M1+INBUF(I*32+J)
      DO 110 J=17,32
        110 M2=M2+INBUF(I*32+J)
      120 CONTINUE
    M3=0
    M4=0
```

```

        DO 150 I=16,31
        DO 130 J=1,16
130     M3=M3+INBUF(I*32+J)
        DO 140 J=17,32
140     M4=M4+INBUF(I*32+J)
150     CONTINUE
C
C TEST ONE
C
        K=0
        IF (M2.NE.0 .AND. M3.NE.0 .AND. ((M1.EQ.0 .AND. M4.NE.0) .OR.
*(M4.EQ.0 .AND. M1.NE.0))) K=1
        IF (M1.NE.0 .AND. M4.NE.0 .AND. ((M2.EQ.0 .AND. M3.NE.0) .OR.
*(M3.EQ.0 .AND. M2.NE.0))) K=8
        IF (K .NE. 0) GOTO 29
C
C TEST TWO
C
        IF (M1.NE.0 .OR. M2.NE.0 .OR. M3.EQ.0 .OR. M4.EQ.0) GOTO 300
        M3=0
        M4=0
        DO 210 I1=16,31
        DO 200 J1=1,16
        M3=M3+INBUF(I1*32+J1)
        IF (M3 .GE. 1000) GOTO 220
200     CONTINUE
210     CONTINUE
220     DO 240 I2=16,31
        DO 230 J2=17,32
        M4=M4+INBUF(I2*32+J2)
        IF (M4 .GE. 1000) GOTO 250
230     CONTINUE
240     CONTINUE
250     M3=I1*32+J1
        M4=I2*32+J2-16
        K=8
        IF (M3 .GE. M4) K=1
        GOTO 29
300     IF (M3.NE.0 .OR. M4.NE.0 .OR. M1.EQ.0 .OR. M2.EQ.0) GOTO 400
        M1=0
        M2=0
        DO 320 I1=0,15
        DO 310 J1=1,16
        M1=M1+INBUF(I1*32+J1)
        IF (M1 .GE. 1000) GOTO 325
310     CONTINUE
320     CONTINUE
325     DO 340 I2=0,15
        DO 330 J2=17,32
        M2=M2+INBUF(I2*32+J2)
        IF (M2 .GE. 1000) GOTO 350
330     CONTINUE
340     CONTINUE
350     GOTO 250
C

```

C TEST THREE

C

```

400 IF (M1.NE.0 .OR. M3.NE.0 .OR. M2.EQ.0 .OR. M4.EQ.0) GOTO 500
    M2=0
    M4=0
    DO 420 I1=17,32
    DO 410 J1=0,15
    M2=M2+INBUF(J1*32+I1)
    IF (M2 .GE. 1000) GOTO 430
410 CONTINUE
420 CONTINUE
430 DO 450 I2=17,32
    DO 440 J2=16,31
    M4=M4+INBUF(J2*32+I2)
    IF (M4 .GE. 1000) GOTO 460
440 CONTINUE
450 CONTINUE
460 GOTO 250
500 IF (M2.NE.0 .OR. M4.NE.0 .OR. M1.EQ.0 .OR. M3.EQ.0) GOTO 600
    M1=0
    M3=0
    DO 520 I1=1,16
    DO 510 J1=0,15
    M1=M1+INBUF(J1*32+I1)
    IF (M1 .GE. 1000) GOTO 530
510 CONTINUE
520 CONTINUE
530 DO 550 I2=1,16
    DO 540 J2=16,31
    M3=M3+INBUF(J2*32+I2)
    IF (M3 .GE. 1000) GOTO 560
540 CONTINUE
550 CONTINUE
560 GOTO 250

```

C

C TEST FOUR

C

```

600 IF (M1.EQ.0 .OR. M2.EQ.0 .OR. M3.EQ.0 .OR. M4.EQ.0) GOTO 700
620 IF (IXFRM(18) .LE. 0) K=1
    IF (IXFRM(18) .GT. 0) K=8
    GOTO 29

```

C

C TEST FIVE

C

```

700 IF (M2.EQ.0 .AND. M3.EQ.0 .AND. ((M1.NE.0 .AND. M4.EQ.0) .OR.
    *(M4.NE.0 .AND. M1.EQ.0))) K=1
    IF (M1.EQ.0 .AND. M4.EQ.0 .AND. ((M2.NE.0 .AND. M3.EQ.0) .OR.
    *(M3.NE.0 .AND. M2.EQ.0))) K=8
    IF (K .NE. 0) GOTO 29
    WRITE (1,710)
710 FORMAT (' IMAGE DOES NOT FIT ANY TESTS')
    RETURN

```

C

C ROAD INTERSECTIONS

C

```

      810 MINNUM=19
          GOTO 65
      800 K=17
C
C FIND CLOSEST MATCH
C
      29 AMIN=1000.
          L=3
          IF (K.EQ.1 .OR. K.EQ.8) L=8
          DO 40 I=K,K+L
              DIF=0.
              IF (I .EQ. 19) GOTO 40
              DO 30 J=1,16
      30  DIF=DIF+(COLM(J)/ITOT-CONS(I,J))*2
              IF (DIF .GE. AMIN) GOTO 40
              AMIN=DIF
              MINNUM=I
      40  CONTINUE
          IF (MINNUM .GT. 16) GOTO 60
          IF (MINNUM .LT. 8) ANGLE=MINNUM*11.25
          IF (MINNUM .EQ. 8) ANGLE=0.
          IF (MINNUM .GT. 8) ANGLE=(MINNUM-1)*11.25
          WRITE (LUOT,50) ANGLE
      50  FORMAT (' LINE ROAD AT ',F6.2,' DEGREES')
          RETURN
      60  IF (MINNUM.EQ.17) GOTO 65
          C=0
          D=0
          DO 62 I=1,32
              C=C+INBUF(I)
              D=D+INBUF(992+I)
              IF (C.EQ.300 .OR. D.EQ.300) GOTO 63
      62  CONTINUE
      63  MINNUM=18
          IF (D .GT. C) MINNUM=20
      65  ANGLE=(MINNUM-17)*22.5
          WRITE (LUOT,70) ANGLE
      70  FORMAT (' INTERSECTION AT ',F6.2,' DEGREES')
          RETURN
          END
          END$

```



